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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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EXAMINER

SONG, MATTHEW J

ART UNIT	PAPER NUMBER
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1722

DATE MAILED: 06/14/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No. 09/728,193	Applicant(s) MORITA, ETSUO	
	Examiner Matthew J. Song	Art Unit 1722	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 30 March 2005.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1,2,4-20 and 23-26 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1,2,4-20 and 23-26 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
 Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
 Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|---|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____ |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

2. Claims 1, 2, 4-20 and 23-26 are rejected under 35 U.S.C. 103(a) as being unpatentable over Pribat et al (US 4,952,526) or Tsuda et al (US 6,294,440) in view of Natsume (US 5,672,520).

Pribat et al discloses a wafer 1 made of GaAs or InP (claim 14), this reads on applicant's basal body, depositing a dielectric thin layer 2 of silicon nitride or silica (claim 12-13), where excellent deposition selectivity can be obtained between GaAs and a silicon nitride film by plasma assisted CVD (claim 16-17) (col 10, ln 1-35) with a thickness between 5×10^{-2} and a few micrometers, etching a set of bands 23,24 (claim 2 and 7) on the dielectric using means known to those skilled in the art such as photolithography or wet or dry chemical attack (col 4, ln 50-60), where the bands 23,24 have a width of 0.5 to a few microns and being spaced out at distances of some microns to several hundred microns, thus periodically baring the substrate (col 10, ln 50-67 and col 11, ln 1-10 and Figs 23-24). Pribat et al also discloses a deposition of a thin film of III-V compound is deposited on the preceding structure by MOCVD, with a thickness of a few hundred angstroms to a few microns and depositing a second layer of dielectric, with a thickness of a few hundred angstroms to a few micrometers (col 11, ln 11-38 and Fig 26). Pribat et al also discloses apertures are etched in a second layer of the dielectric and the apertures are offset with

Art Unit: 1722

respect to the previous ones and the offset can vary from some micrometers to some hundreds of micrometers, this reads on applicant's forming patterns at least partly overlies one another and at least partly do not overlies one another. Pribat et al also discloses III-V polycrystalline material is removed by chemical attack through the apertures, this reads on applicant's forming an indentation (claim 16-19) so as to bare the monocrystalline seed through the apertures and growing a thin layer of monocrystalline III-V material between the dielectric layers and the upper dielectric is removed throughout the surface of the wafer so as to obtain a monocrystalline thin layer of semiconductor (claim 17) (col 11, ln 39-67 and Fig 27). Pribat et al also discloses repeating the disclosed method to obtain a stacking shown in Fig 14 (claims 16-19) (col 12, ln 1-25 and Figs 22-31). Pribat et al discloses a base layer 32 in Fig 31 (claims 11 and 16-19). Pribat et al also discloses a first pattern of dielectric material 50 and 51 with different lengths than a second pattern of dielectric material 20 and 21 in Fig 19.

Tsuda et al discloses a GaN layer 101, this reads on applicant's base layer, is grown to a thickness of about 4 micrometers on a sapphire substrate 100 (claim 14) is placed in a growth chamber and a first patterned mask made of SiO₂ (claim 12-13) is formed on the GaN layer 101 by sputtering (claim 15) and the SiO₂ film is patterned to a periodic strip with a width of about 7 micrometers and a pitch of about 10 micrometers by conventional photolithography method, whereby a first SiO₂ mask 102 is formed (col 7, ln 20-45). Tsuda et al also discloses a GaN crystal film 103 is grown by Metal organic vapor phase epitaxy (MOVPE) to a thickness of about 3 micrometers and a forming a second mask on the GaN film 103. Tsuda et al also discloses the second mask film 104 is a SiO₂ film with a thickness of about 200 nm with a periodic strip pattern (claim 2 and 7) with a width of about 8 micrometers and a pitch of about 10

Art Unit: 1722

micrometers is formed by a photolithography method and forming a GaN single crystal film 105 thereon by MOVPE (col 7, ln 46-67 and col 8, ln 1-30 and Fig 1). Tsuda et al also discloses it is important to select a relationship between the size of each opening of the first mask and the stripe width of the second mask, depending upon required characteristics of a light-emitting device, this reads on applicant's pitch of pattern elements (col 8, ln 31-65). Tsuda et al also discloses a semiconductor substrate including a sapphire substrate can also be used as a substrate, where a sapphire substrate may be peeled off from a semiconductor structure by grinding or etching and the remaining structure can be used as a substrate (claims 20 and 24) (col 22, ln 2-60).

Pribat et al or Tsuda et al does not disclose the pitch of pattern elements of one of the plurality of patterns and pitch of pattern elements of another of the plurality of patterns are different from each other.

In a method of checking alignment accuracy in photolithography, Natsume teaches three alignment check patterns 10, 20 and 100 are used. Natsume teaches alignment check pattern 10 consists of seven rectangular pattern elements, which are arranged parallel to each other in a row at a constant pitch q. Natsume also teaches alignment check pattern 100 consist of seven rectangular pattern elements which are arranged parallel to each other at a constant pitch p and pitch p differs from the pitch q of the pattern elements of alignment check patterns 10, 20 (col 3, ln 1-50). Natsume also teaches in a composite layout, the underlying check patterns 10, 20 and each of the pattern elements of the overlying pattern 100 partly overlaps both a pattern elements of the first and second check pattern (col 3, ln 51-67). Natsume also teaches the second plurality of patterns partly overlies and partly does not overlie the first plurality of patterns in the direction

Art Unit: 1722

of the thickness of the crystal (Fig 2(B)). Natsume teaches using different pitches and a region where the patterns do not overlap; therefore overlapping is at least in part due to the difference in pitches because it is a natural effect from using different pitches. It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify Tsuda et al or Pribat et al's method of forming patterns using photolithography with Natsume's method of checking the alignment in photolithography using pattern elements with different pitches to check the alignment of the patterns (col 2, ln 40-55).

Referring to claim 4, the combination of Tsuda et al and Natsume or the combination of Pribat et al and Natsume does not teach the claimed relationship between the pitch of pattern elements. It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify the combination of Tsuda et al and Natsume or the combination of Pribat et al and Natsume to select any proportion of pitches that would produce a desired alignment because Natsume does not restrict the ratio of pitches (col 4, ln 40-55). In the absence of unexpected results, any ratio of pitches would have been obvious.

Referring to claims 5-6, the combination of Tsuda et al and Natsume or the combination of Pribat et al and Natsume teaches using patterns with different lengths 13, 14 ('520 Fig 1), which also reads on width because width and length are merely different based on perspective and the width is measure relative to the length, which is not defined.

Referring to claim 7, the combination of Tsuda et al and Natsume or the combination of Pribat et al and Natsume teaches stripes.

Art Unit: 1722

Referring to claim 8-9, the combination of Tsuda et al and Natsume or the combination of Pribat et al and Natsume teaches a region where the pattern element 101 does not overlies pattern elements 10,20 in Figure 2(A) of Natsume.

Referring to claim 10-15, the combination of Tsuda et al and Natsume or the combination of Pribat et al and Natsume teaches using SiO₂ mask on a sapphire substrate to grow GaN ('440 col 7, ln 20-67).

Referring to claim 16-19, the combination of Tsuda et al and Natsume or the combination of Pribat et al and Natsume teaches etching and using a masking material.

Referring to claim 20, the combination of Tsuda et al and Natsume or the combination of Pribat et al and Natsume teaches removing the substrate ('440 col 22, ln 10-55).

Referring to claim 23-26, the combination of Tsuda et al and Natsume or the combination of Pribat et al and Natsume teaches using a plurality of patterns with different pitches ('520 col 3, ln 1-67).

Response to Arguments

3. Applicant's arguments filed 3/30/2005 have been fully considered but they are not persuasive.

Applicant's argument that the overlapping and non-overlapping portions of Natsume are not due to the different pitches is noted but is not found persuasive (pg 12-13). Claim 1 merely recites, "due at least in part to the different pitches" in line 15. Natsume teaches overlapping and non-overlapping regions (Fig 2B) and different pitches (col 4, ln 1-67). The non-overlapping

Art Unit: 1722

region and overlapping region is due primarily to misalignment but due in part to the different pitches also; therefore meets the claimed limitation.

Applicant's argument that Natsume teaches away from the present invention is noted but is not found persuasive. Natsume may teach away from **present** invention, however Natsume does not teach away from the **claimed** invention. Natsume teaches using a plurality of patterns with different pitches used for detecting alignment errors when the patterns partly do not overlap, which meets the claimed invention.

In response to applicant's argument that applicant purpose is to avoid accurate alignment is different from the intended use of Natsume for accurate alignment, the fact that applicant has recognized another advantage which would flow naturally from following the suggestion of the prior art cannot be the basis for patentability when the differences would otherwise be obvious. See *Ex parte Obiaya*, 227 USPQ 58, 60 (Bd. Pat. App. & Inter. 1985). Natsume teaches using a plurality of patterns with different pitches to detect alignment errors, which meets the claimed limitations.

Applicant's arguments regarding claim 4 are noted but are not found persuasive (pg 13). The range of pitch relationships claimed $0.1 \mu\text{m} < p_1 \times p_2 / |p_2 - p_1| < 5000 \mu\text{m}$ is a large range and relationship between the first pitch and the second pitch is taught by Natsume to be $p = 0.95q$ (col 3, ln 25-50) and Tsuda et al teaches using pitches of $10 \mu\text{m}$ (col 7, ln 20-45), which falls within the huge range claimed by applicant. The Examiner maintains that it would have been obvious to a person of ordinary skill in the art to select any proportion of pitches that would produce a desired alignment because Natsume does not restrict the ratio of pitches (col 4, ln 40-55). In the

Art Unit: 1722

absence of unexpected results, any ratio of pitches would have been obvious. There is no showing of unexpected results for the claimed relationship; therefore the rejection is maintained.

Applicant's argument regarding claim 5 are noted but are not found persuasive (pg 14). The patterns elements taught by Natsume having varying lengths, which change the pitch of the elements; therefore meet the claimed limitation. Pitch is related to length of pattern elements.

Applicant's arguments regarding claim 6 are noted but are not found persuasive. Width is measured relative to the length and the length is not defined; therefore different lengths taught by Natsume also read on width because width is not defined. The difference between length and width is perspective; therefore length can be interpreted to read on width.

Applicant's arguments regarding claims 8-10 are noted but are not found persuasive. The claims require a pattern element arranged in two directions in a plane, which merely requires the pattern elements to be arranged in the vertical and horizontal direction, which the elements clearly are taught by Natsume in Fig 1.

Applicant's argument regarding claims 16-19 are noted but is not found persuasive. Pribat teaches removing material through the apertures, which is what a mask is used form and etching which forms indentations. The limitations are taught by Pribat and meet the claim language.

Conclusion

4. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Art Unit: 1722

Gardner et al (US 6,051,876) teaches a plurality of patterns **152** having different spacing and sizes, which reads on applicants' different pitch, in Figures 1B and 1C.

5. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than **SIX MONTHS** from the date of this final action.

6. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Matthew J. Song whose telephone number is 571-272-1468. The examiner can normally be reached on M-F 9:00-5:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Duané Smith can be reached on 571-272-1166. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Art Unit: 1722

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

MJS
June 2, 2005

Matthew J Song
Examiner
Art Unit 1722



**ROBERT KUNEMUND
PRIMARY EXAMINER**